CELL MEMBRANE

&
eukaryotic organelles

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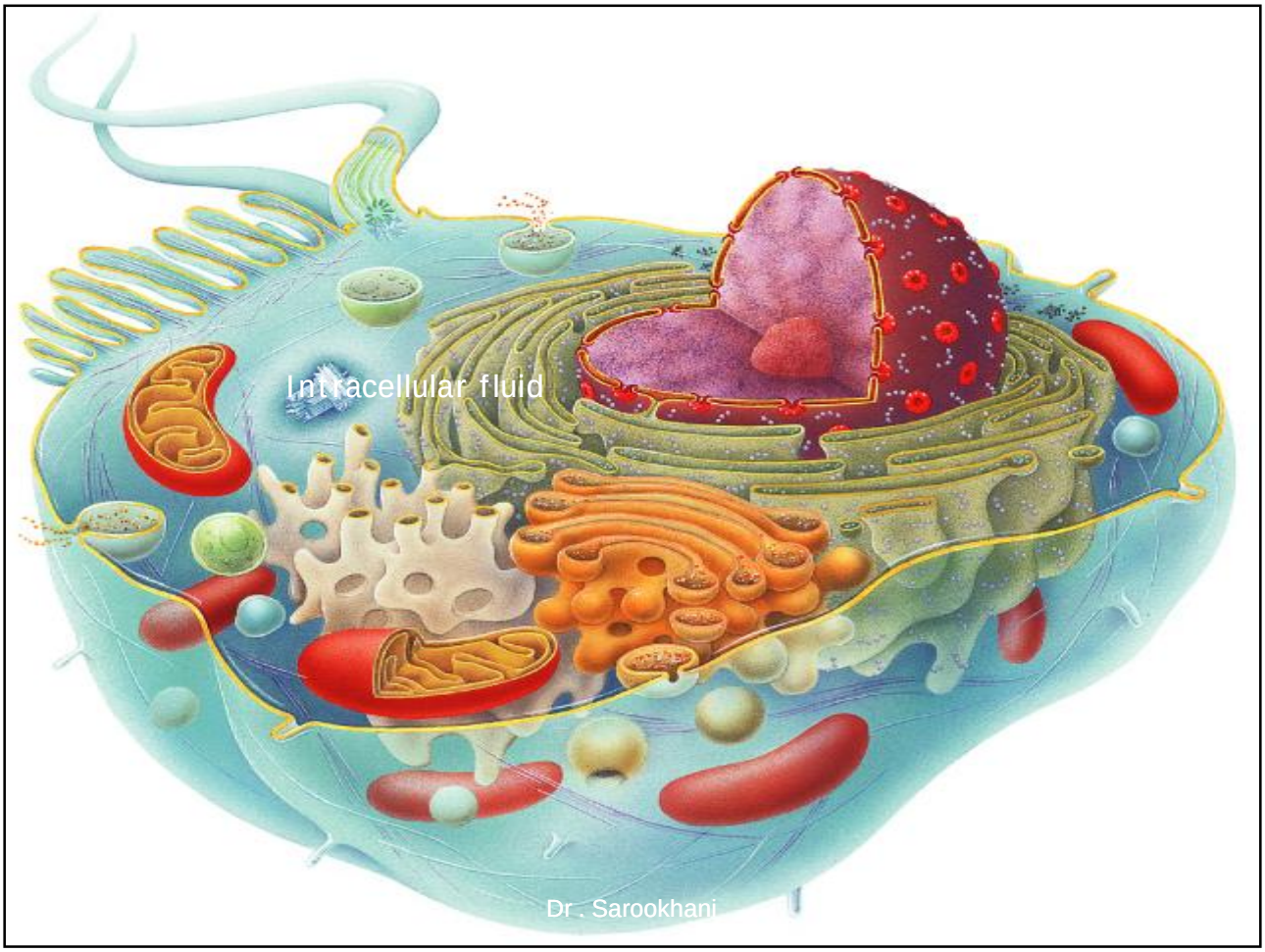
Intracellular fluid
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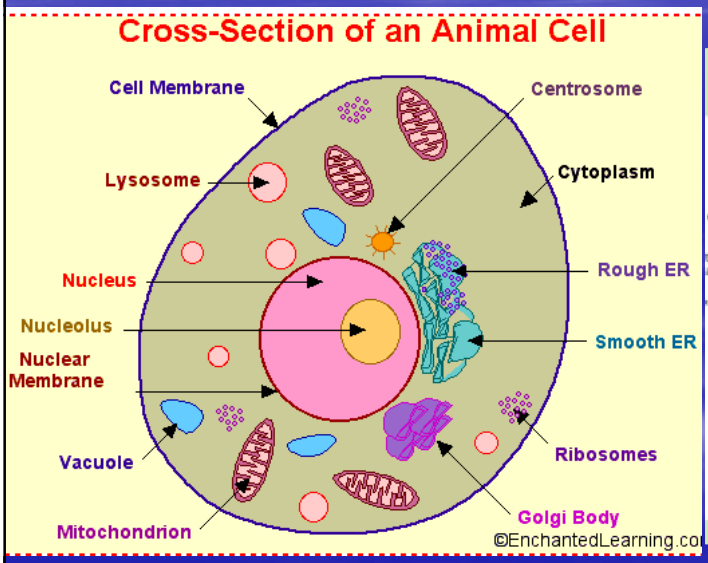
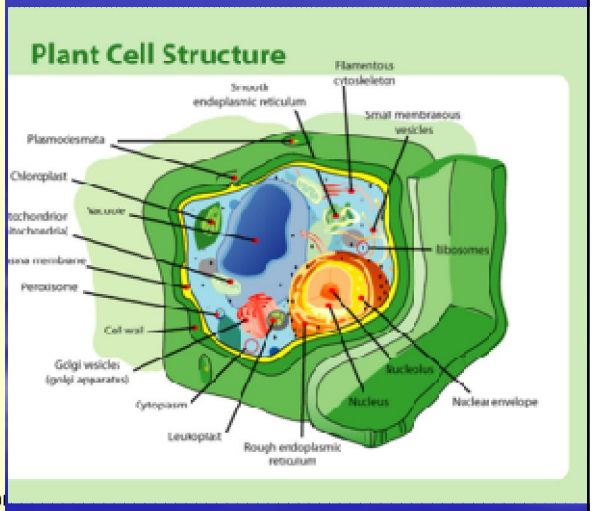
ANIMAL CELL and PLANT CELL





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BIOLOGICAL FUNCTIONS OF CELL MEMBRANE

- Compartmentation
- barrier to diffusion
- osmosis regulation
- transport(active,passive&bulk :exo&endo)
- energy production (phosphorylation & respiration)
- secretion
- irritation
- synapses

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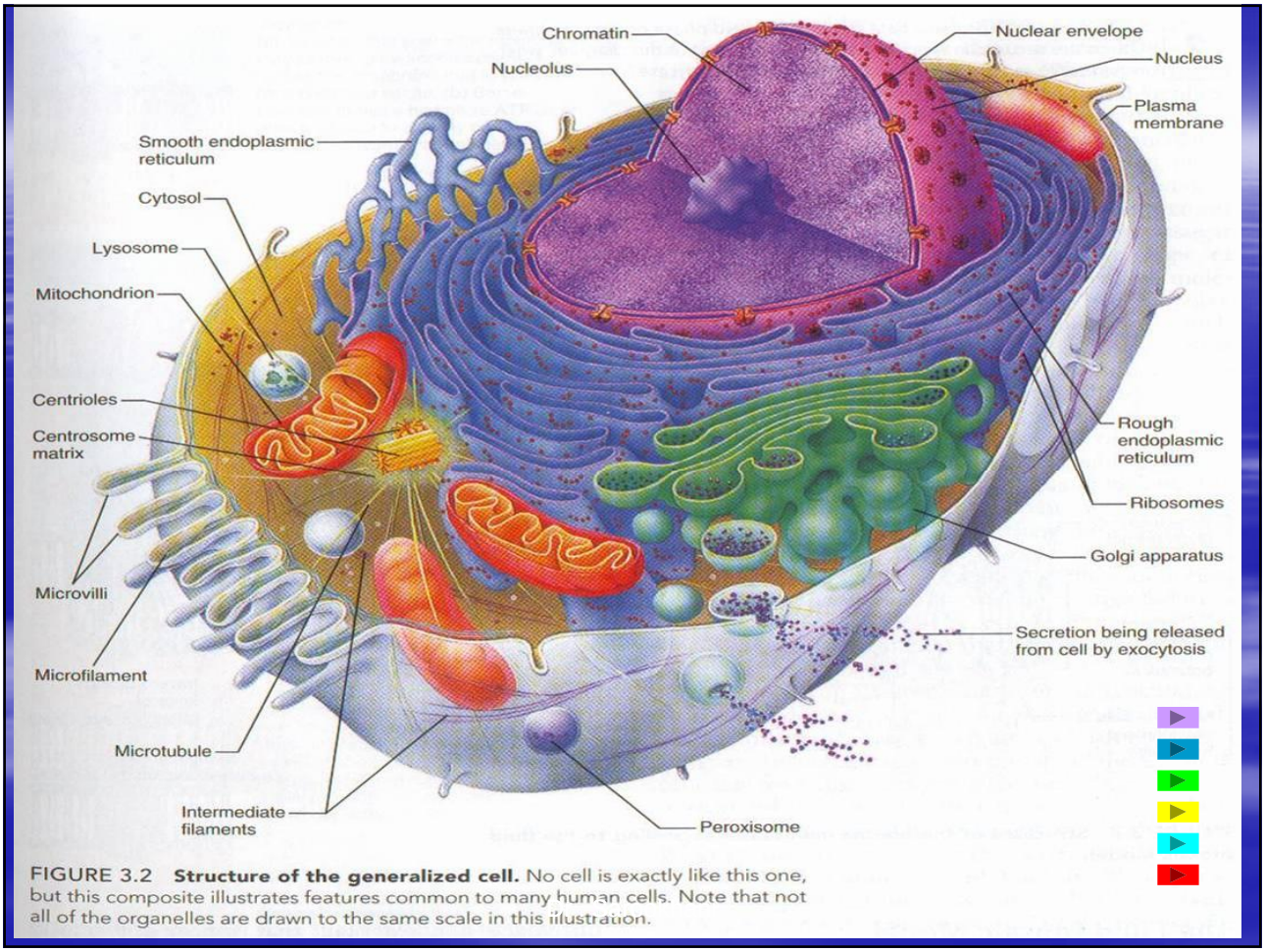
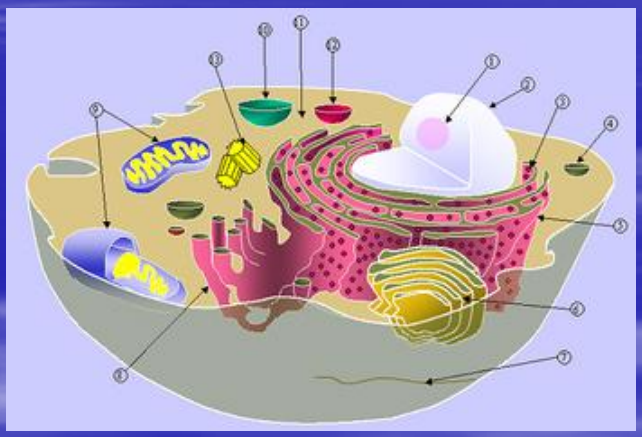


FIGURE 3.2 **Structure of the generalized cell.** No cell is exactly like this one, but this composite illustrates features common to many human cells. Note that not all of the organelles are drawn to the same scale in this illustration.

INTRACELLULAR ORGANELLS



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Endoplasmic reticolum (Ergastoplasm) types:

- RER:Rough endoplasmic reticulum (Rough ER) is so-named because of its rough appearance due to the numerous ribosomes that occur along the ER. Rough ER connects to the nuclear envelope through which the messenger RNA (mRNA) that has the primary information for proteins, travels to the ribosomes.
- SER:Smooth ER; lacks the ribosomes characteristic of Rough ER and is thought to be involved in transport and a variety of other functions.

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RIBOSOMES:

- Ribosomes are the sites of protein synthesis. They are not membrane-bound and thus occur in both prokaryotes and eukaryotes. Eukaryotic ribosomes are slightly larger than prokaryotic ones. Structurally the ribosome consists of a small and larger subunit. Biochemically the ribosome consists of H2O (50%) and solids (50%) including ribosomal RNA (rRNA)(65%) and some 54 structural proteins(35%) and Ions (traces of Mg++ & Ca++). Often ribosomes cluster on the endoplasmic reticulum, in which case they resemble a series of factories adjoining a railroad line.

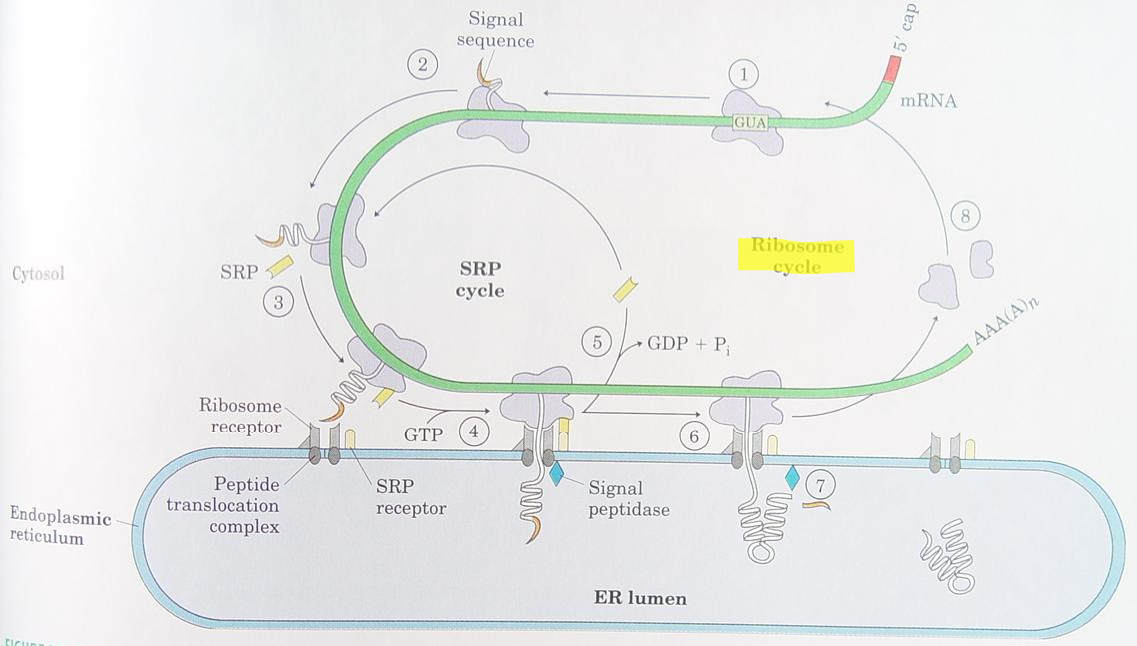


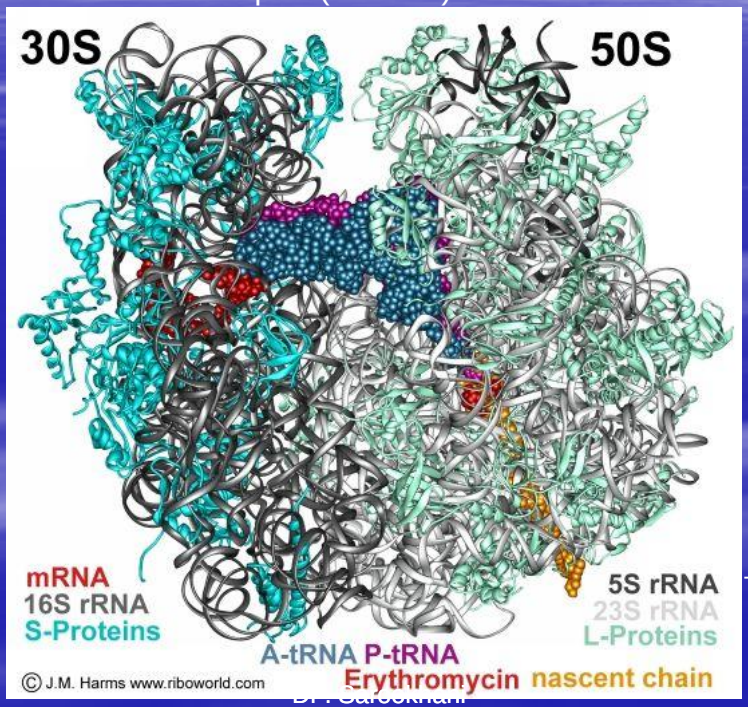
FIGURE 27–38 Directing eukaryotic proteins with the appropriate signals to the endoplasmic reticulum. This process involves the SRP cycle and translocation and cleavage of the nascent polypeptide. The steps are described in the text. SRP is a rod-shaped complex containing a 300 nucleotide RNA (7SL-RNA) and six different proteins (combined M_r 325,000). One protein subunit of SRP binds directly to the signal sequence, inhibiting elongation by sterically blocking the entry of aminoacyl-tRNAs and inhibiting peptidyl transferase. Another protein subunit binds and hydrolyzes GTP. The SRP receptor is a heterodimer of α (M_r 69,000) and β (M_r 30,000) subunits, both of which bind and hydrolyze multiple GTP molecules during this process.

Prokaryotic Ribosomal subunites

54 prot.(S2=L26)

21 prot.

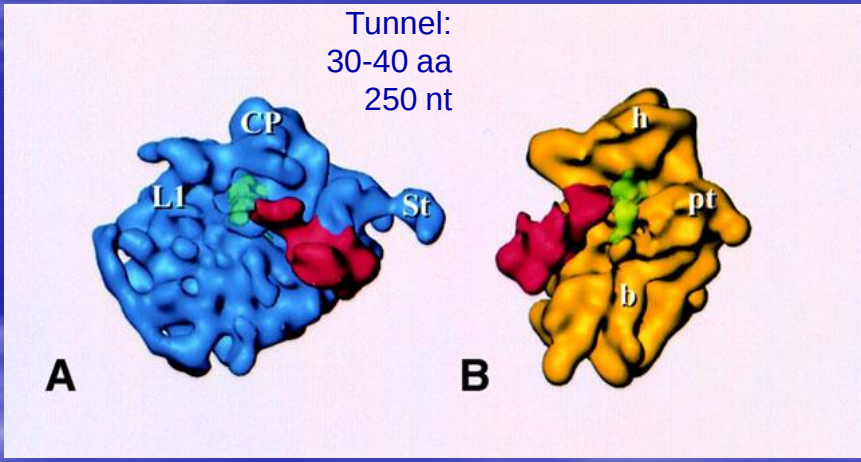
34 prot



Complementary to shin-dalgarno seq.

→ Complementary to Pseudouracil arm

Eukaryotic ribosomes



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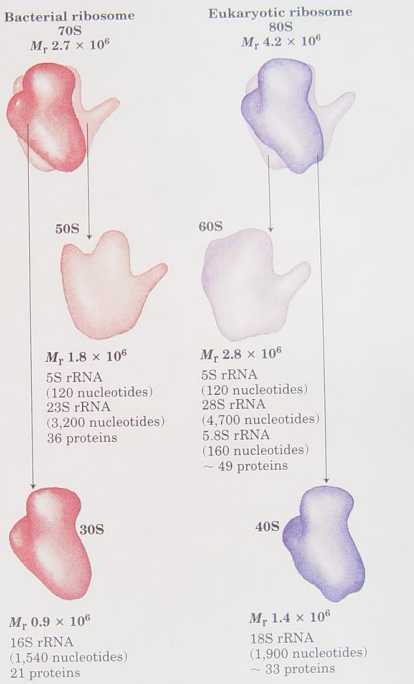

FIGURE 27–15 Summary of the composition and mass of ribosomes in bacteria and eukaryotes. Ribosomal subunits are identified by their S (Svedberg unit) values, sedimentation coefficients that refer to their rate of sedimentation in a centrifuge. The S values are not necessarily additive when subunits are combined, because rates of sedimentation are affected by shape as well as mass.

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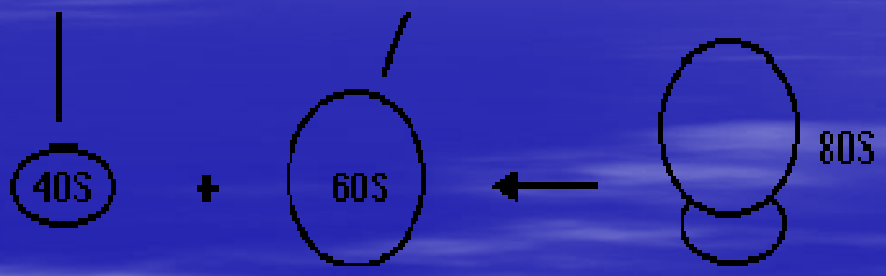
EUKARYOTIC RIBOSOMAL SUBUNITES



30 prot,

70 prot.

40 prot.

Dissociated prot.
Core prot.

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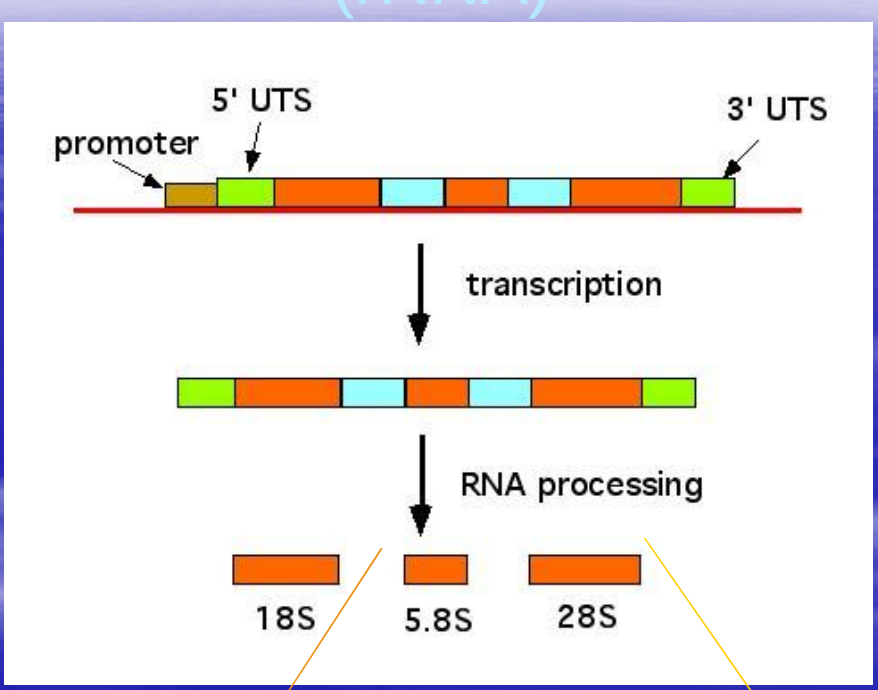
Euokaryotic RIBOSOMAL RNA (rRNA)



5S rRNA from nucleous

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(c) Golgi apparatus

- System of flattened membranous sacs functions in modification & packaging materials for secretion

- It is not in direct continuity with ER; small vesicles pinch off from ER migrate to Golgi apparatus - fuse

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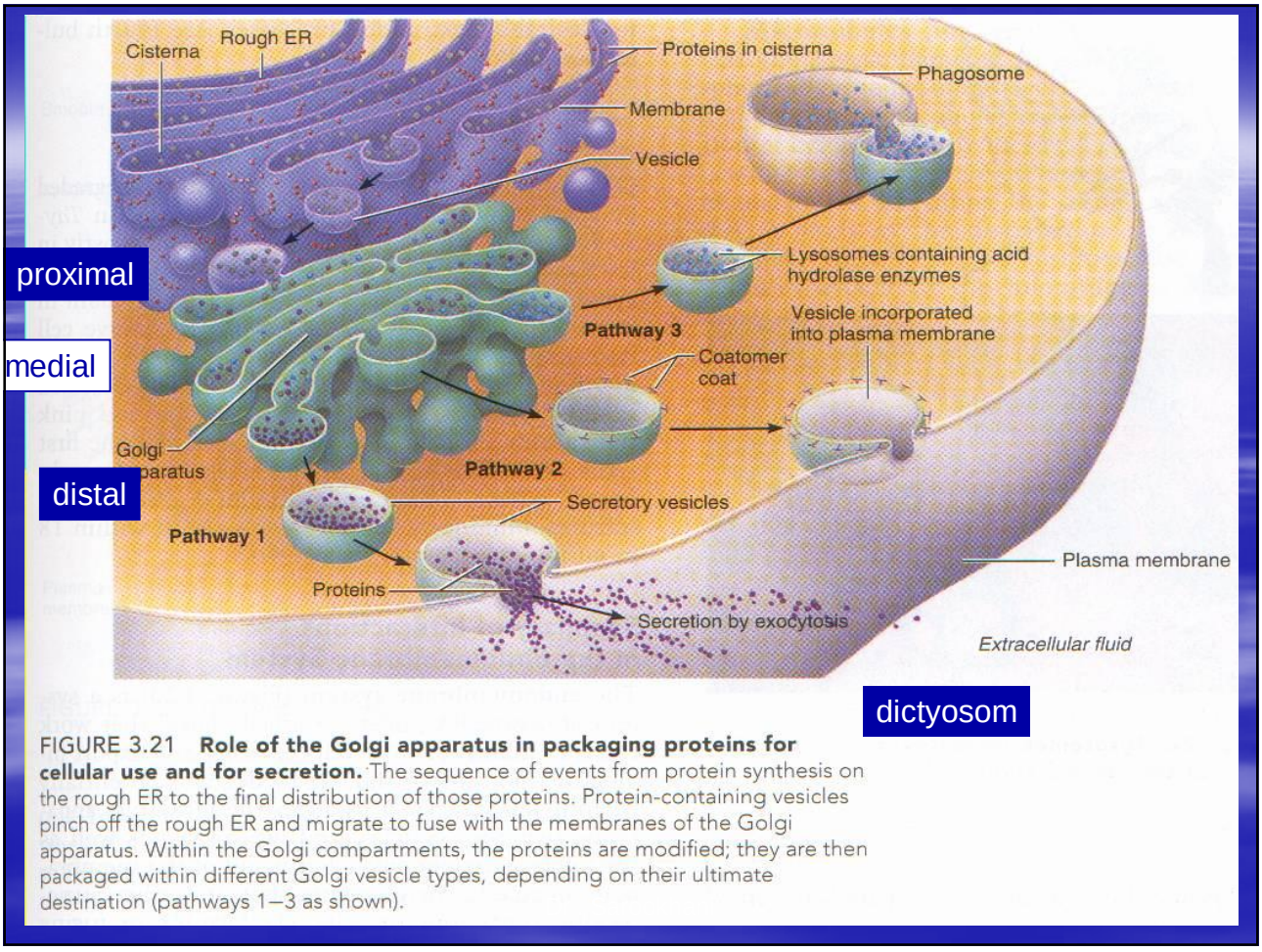

FIGURE 3.21 **Role of the Golgi apparatus in packaging proteins for cellular use and for secretion.** The sequence of events from protein synthesis on the rough ER to the final distribution of those proteins. Protein-containing vesicles pinch off the rough ER and migrate to fuse with the membranes of the Golgi apparatus. Within the Golgi compartments, the proteins are modified; they are then packaged within different Golgi vesicle types, depending on their ultimate destination (pathways 1–3 as shown).

LYSOSOMES FUNCTIONS:

- As a cytolysosomes
- autophagic vacuole
- role in appoptosis (programed cell death)
- role in phagocytosis (phagolysosomes)
- role in inclusion bodies & crystals of cells
- role in diseases

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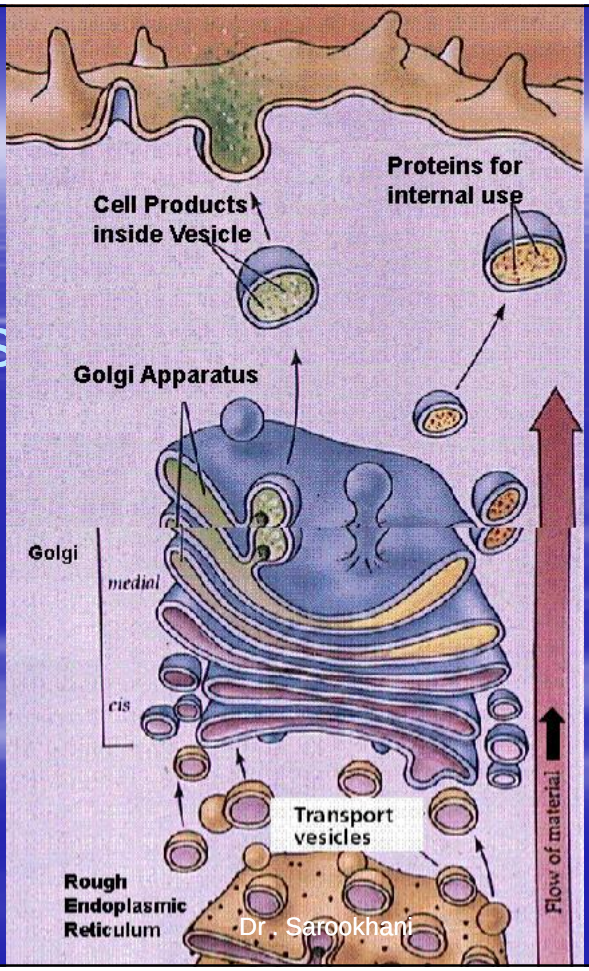
Flow of materials in golgi apparatus



Mitochondria

- 2-6 µm length & 0.2 µm diameter ~ sausage-shaped structure
- Made up of an outer membrane ~ smooth & regular ~ and an inner membrane that is folded to form shelves (*cristae*)

- Space between the 2 membranes ~ *intracristal space*, space inside the inner membrane ~ *matrix space*

- Power-generating units of cell ~ *most plentiful* & *best developed* in parts of cells where energy-requiring processes take place

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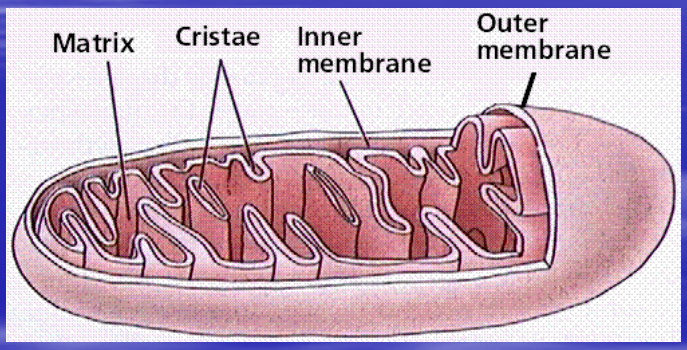
MITOCHONDRIA STRUCTURE



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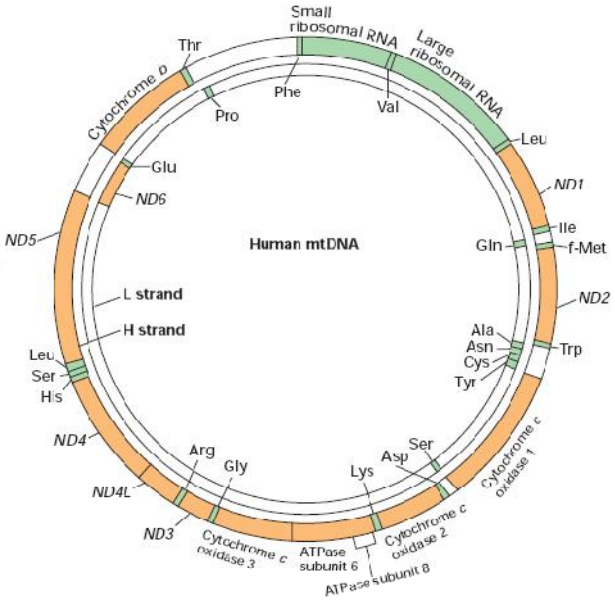
▶ **FIGURE 10-37 The coding capacity of human mitochondrial DNA (mtDNA).** Proteins and RNAs encoded by each of the two strands are shown separately. Transcription of the outer (H) strand occurs in the clockwise direction and of the inner (L) strand in the counterclockwise direction. The abbreviations for amino acids denote the corresponding tRNA genes. *ND1*, *ND2*, etc., denote genes encoding subunits of the NADH-CoQ reductase complex. The 207-bp gene encoding F_0 ATPase subunit 8 overlaps, out of frame, with the N-terminal portion of the segment encoding F_0 ATPase subunit 6. Mammalian mtDNA genes do not contain introns, although intervening DNA lies between some genes. [See D. A. Clayton, 1991, *Ann. Rev. Cell Biol.* **7**:453.]



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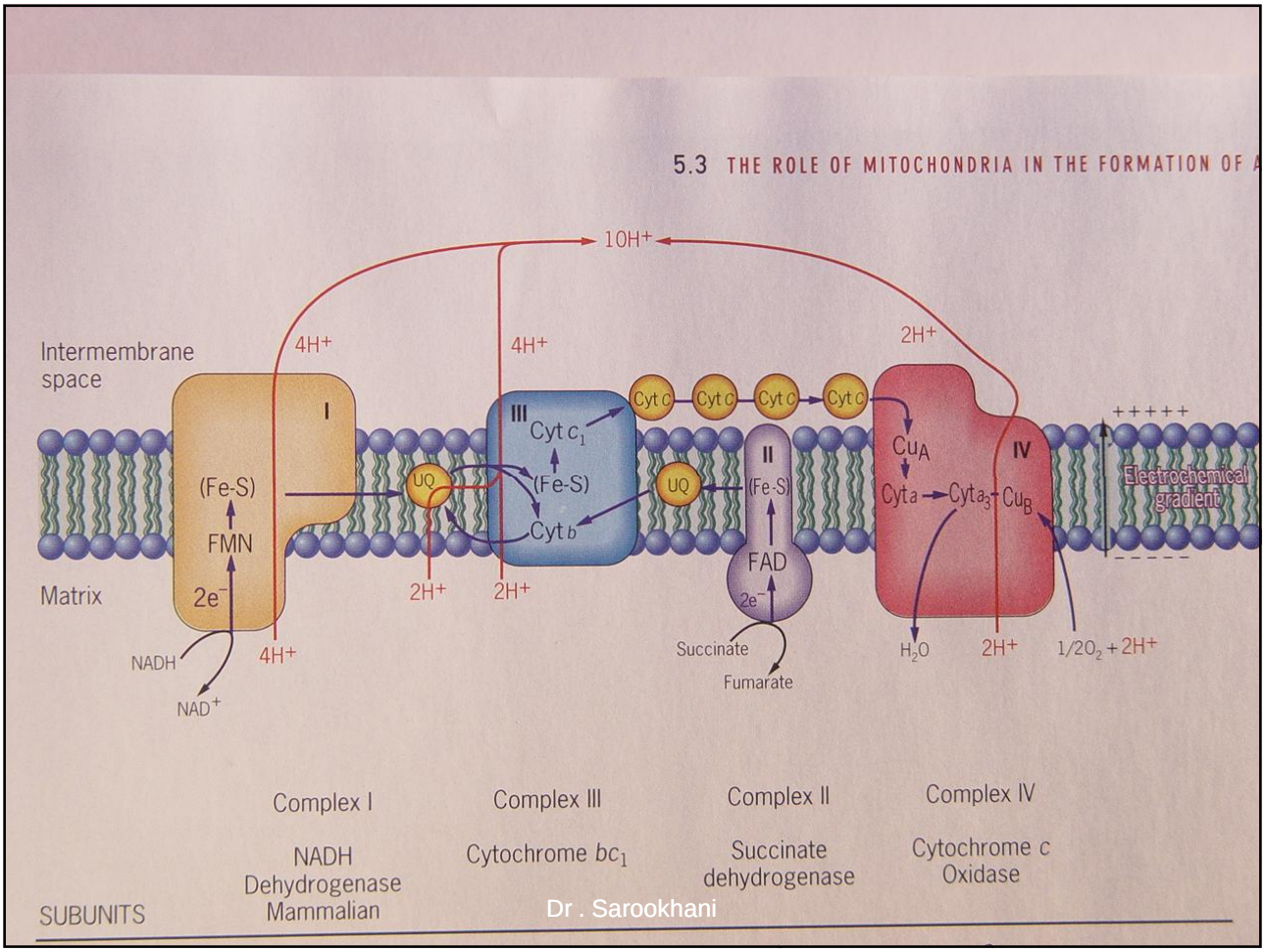
5.3 THE ROLE OF MITOCHONDRIA IN THE FORMATION OF A
10H+
Intermembrane space
4H+
4H+
2H+
I
III
II
IV
Cyt c
Cyt c
Cyt c
Cyt c
Cyt c1
(Fe-S)
Cyt b
UQ
UQ
(Fe-S)
FAD
2e−
CuA
Cyta
Cyta3
CuB
+++++
Electrochemical gradient
Matrix
(Fe-S)
FMN
2e−
NADH
NAD+
4H+
2H+
2H+
Succinate
Fumarate
H2O
2H+
1/2O2 + 2H+
Complex I
NADH Dehydrogenase Mammalian
Complex III
Cytochrome bc1
Complex II
Succinate dehydrogenase
Complex IV
Cytochrome c Oxidase
SUBUNITS
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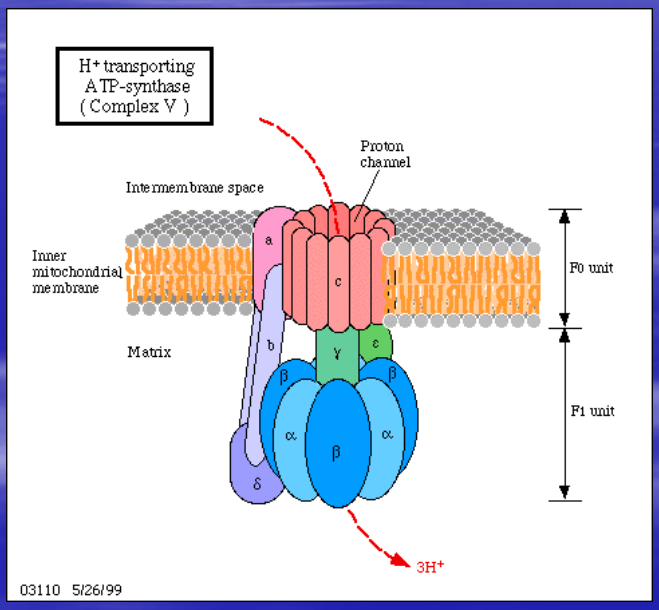
MITOCHONDRIA & F(F1-F0)-ATPase pump (Oxysome)



stalk

base

Head
(Racker factor)

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